

RAKAIA DAVIESAE SP. NOV. (OPILIONES, CYPHOPHTHALMI, PETTALIDAE) FROM AUSTRALIA

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Juberthie, C. 1989 11 13: *Rakaia daviesae* sp. nov. (Opiliones, Cyphophthalmi, Pettalidae) from Australia. *Mem. Qd Mus.* 27(2): 499-507. Brisbane. ISSN 0079-8835.

Rakaia daviesae sp. nov. is from the rainforest of NE Queensland, Australia. The new species has the dorsal side of the single element of tarsus IV of the male divided, and is intermediate between the character states of *Neopurcellia* and *Rakaia*. I retain *Rakaia* and *Neopurcellia* as valid genera. The Pettalidae, limited to *Chiloegovea*, *Pettalus*, *Purcellia*, *Rakaia*, *Austropurcellia* and *Neopurcellia*, is a homogenous family separable from Sironidae by the presence of two kinds of teeth on the moveable finger of chelicerae. However, the relationship of several other African and New Caledonian species (*Parapurcellia*, *Marwe*, *Troglosiro*) which show the main character of Sironidae (one type of teeth), remain an open problem so that the clade, Sironidae-Pettalidae, is probably a limited view of a more complex phylogeny.

L'auteur décrit *Rakaia daviesae* sp. nov. des forêts tropicales du nord-est du Queensland, Australie. Le tarse IV du ♂ est formé d'un article unique, en partie divisé par un sillon transversal dorsal; c'est un trait intermédiaire entre *Rakaia* (1 article) et *Neopurcellia* (2 articles), mais les deux genres semblent valables.

Les Pettalidae, limités à *Chiloegovea*, *Pettalus*, *Purcellia*, *Rakaia*, *Austropurcellia* et *Neopurcellia* forment une famille homogène, distincte des Sironidae par la présence de 2 types de dents au doigt mobile des chélicères. Cependant, la position phylogénique d'autres genres africains (*Parapurcellia*, *Marwe*) et de Nouvelle-Calédonie (*Troglosiro*) est difficile à établir; de ce fait, la distinction Sironidae-Pettalidae est peut-être une vue limitée d'une phylogénie plus complexe.

□ *Rakaia daviesae*, Opiliones, Pettalidae, Queensland, Australia.

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Four genera of Cyphophthalmi have been described from Australia, New Zealand and New Caledonia: *Rakaia* Hirst, 1925, *Neopurcellia* Forster, 1948, *Troglosiro* Juberthie, 1979, and *Austropurcellia* Juberthie, 1988. Forster (1948, 1952) described 20 species of *Rakaia* and 3 species of *Neopurcellia* from New Zealand and recorded the first cyphophthalmid from Australia: *Rakaia woodwardi* Forster, 1955. Two further Australian species, *Neopurcellia capricornia* Davies, 1977, and *Rakaia arctica* Cantrell, 1980, have been described. *Troglosiro* has not been found outside New Caledonia.

All the Australian species of the Cyphophthalmi have been found in tropical Queensland. In this paper, I describe a new species, *Rakaia daviesae* from that region. All the specimens examined are in the Queensland Museum (QM). Several other new species will be described in a further paper.

Rakaia Hirst

Since the description of *Rakaia woodwardi* by Forster (1955), numerous new delicate characters have come into use for the description of Cyphophthalmi, and it is necessary to add more detail to

the generic description of *Rakaia* based on examination of *R. antipodiana* Hirst, *R. woodwardi* Forster and *R. daviesae* sp. nov. Metatarsi I and II have only dorsal and dorsolateral surfaces granulate, otherwise smooth (Forster — 'Metatarsi I and II entirely granulate'). Movable finger of chelicera with two kinds of teeth. Sternite 8, sternite 9 and tergite IX (together forming the corona analis) distinct in all species. Anal glands present in male. Ovipositor with subapical sensory process. These latter two characters were not confirmed in the type species, *R. antipodiana*.

Rakaia daviesae sp. nov.
(Figs 1-7)

MATERIAL EXAMINED

HOLOTYPE: ♂, sieved litter, rainforest, 10 m, Graham Range, NE Queensland (QM Berlesate No. 3, 17°17'S, 145°57'E), G.B. Monteith, 9 Apr. 1979. QM S6441.

ALLOTYPE: ♀, same data as above. QM S6442.

PARATYPES: 2 ♂, 3 ♀, same data as above, QM S6443.

DESCRIPTION OF MALE

Colour: Dark reddish brown body; red brown

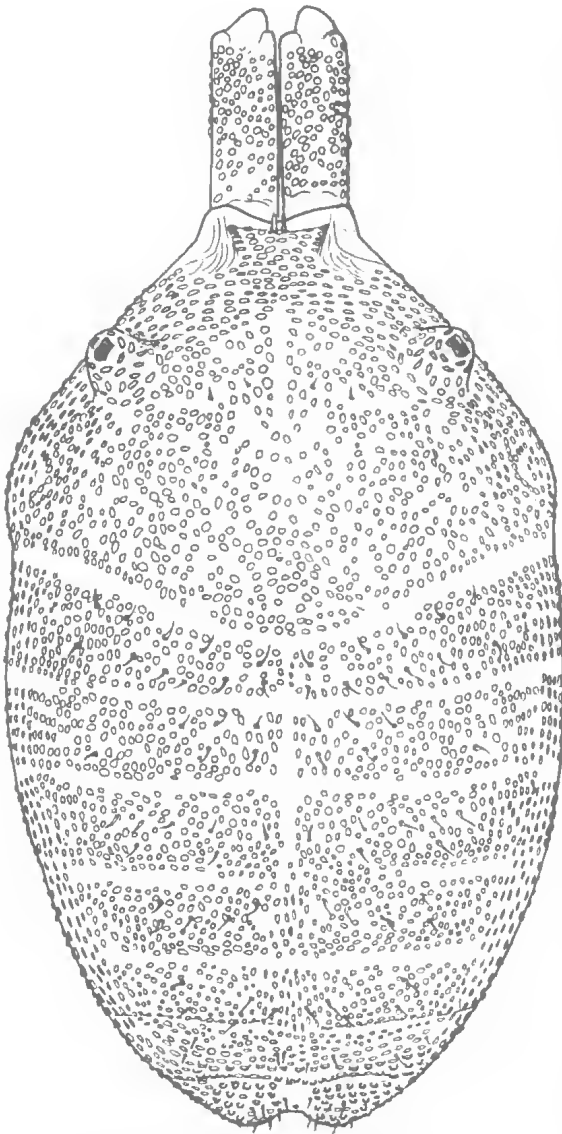


FIG. 1. Habitus of ♂ *Rakaia daviesae* sp. nov.

chelicerae; light yellow brown appendages and tubercles of the odoriferous glands.

Body: Body length 2.00 mm; greatest width, measured at opisthosoma, 1.15 mm (Fig. 1).

Dorsal shield completely fused. Surface granulate; tergites clearly defined by straight transverse grooves which are areas without granules and with only very small thorns; a shallow median groove separates each of the first three tergites. On tergite IV this groove has a blurred outline because several elongate granulations are present, and it disappears on tergites V–VII.

Setation sparse on prosoma; two transverse rows of 4, 5 or 6 short setae on each side of tergites I–IV, irregular in position and number on the others. Medio-anterior part of cephalothorax (prosoma) with a short median projection bearing basal segment of chelicerae; lateral parts of the projection not granulate.

Tergite VIII with a pronounced median groove without granulations and scopulae. One sagittal opening of anal gland in the median groove of tergite VIII (Figs 1–3). Twin parasagittal openings of other anal glands between tergites VIII and IX (Figs 2,3). On each side of the groove 6–8 setae (same type as other tergites) that do not form a tuft.

Odoriferous gland mounds conical, nearly vertical, set a distance equal to half of their diameter from lateral margins of dorsal shield. In dorsal view, apical part of the mounds projects beyond margin of scutum.

Coxae I and II free (Fig. 3a). Coxae III and IV fused in midline. Aperture of coxal glands between coxae III and IV. Coxae IV delineate anterior part of genital aperture. Sternites with short setae all of the same type. Corona analis (Fig. 3b and c). Sternite 9 free and smooth; tergite IX free, divided and partly granulate. Anal plate with deep, broad sagittal groove and two lateral granulate protuberances; each inner wall of protuberances with scopula of curved setae.

Chelicerae: Basal segment granulate, with dorsal transverse ridge and four dorsal setae. Second segment smooth as in Forster (1955, fig. 4). Two types of teeth on inner surface of the movable finger (Fig. 4a). Second segment $2.7 \times$ length of movable finger.

Pedipalps (Fig. 4b): Trochanter with a strong ventral process (Fig. 4c); femur surface smooth; tarsus with claw and two subapical sensory solenidia.

Legs (Fig. 5): Legs I and II uniformly granulate with secondary ornamentation (small thorns between the granulations), except tarsi which are wholly smooth and metatarsi which have granulations and ornamentation confined to dorsal and dorsolateral sides of the proximal part. Dorsal side of metatarsi with two successive different curvatures. All segments of legs III and IV granulate except the tarsi.

Tarsus I differs from the others by its shape; it is enlarged and has a ventral brush of short, close-set, wiry hairs distally. Tarsi of legs I and II with dorsal solenidia (respectively 8 and 10) and a subapical sensory process. All segments with long bristles (sensilla chaetica); metatarsi and tarsi of

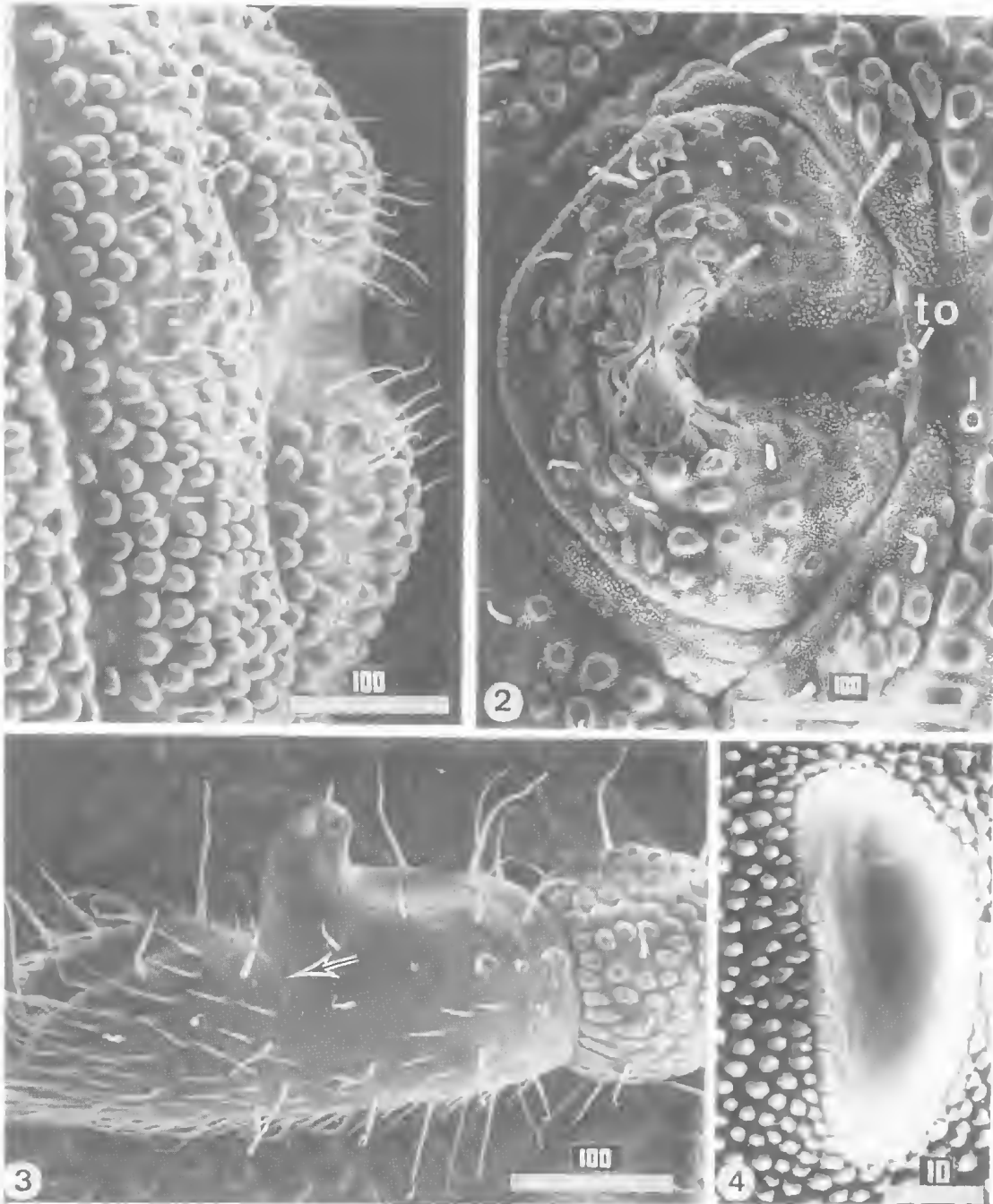


FIG. 2. ♂ *Rakaia daviesae* sp. nov. 1. Body, posterior part, dorsal view; 2. corona analis; 3. tarsus smooth and metatarsus IV granulate; 4. a granulation on the prosoma (first level of ornament) and small thorns (second level of ornament). o = opening of the anal gland; to = twin openings; arrow = transverse groove limited to dorsal side.

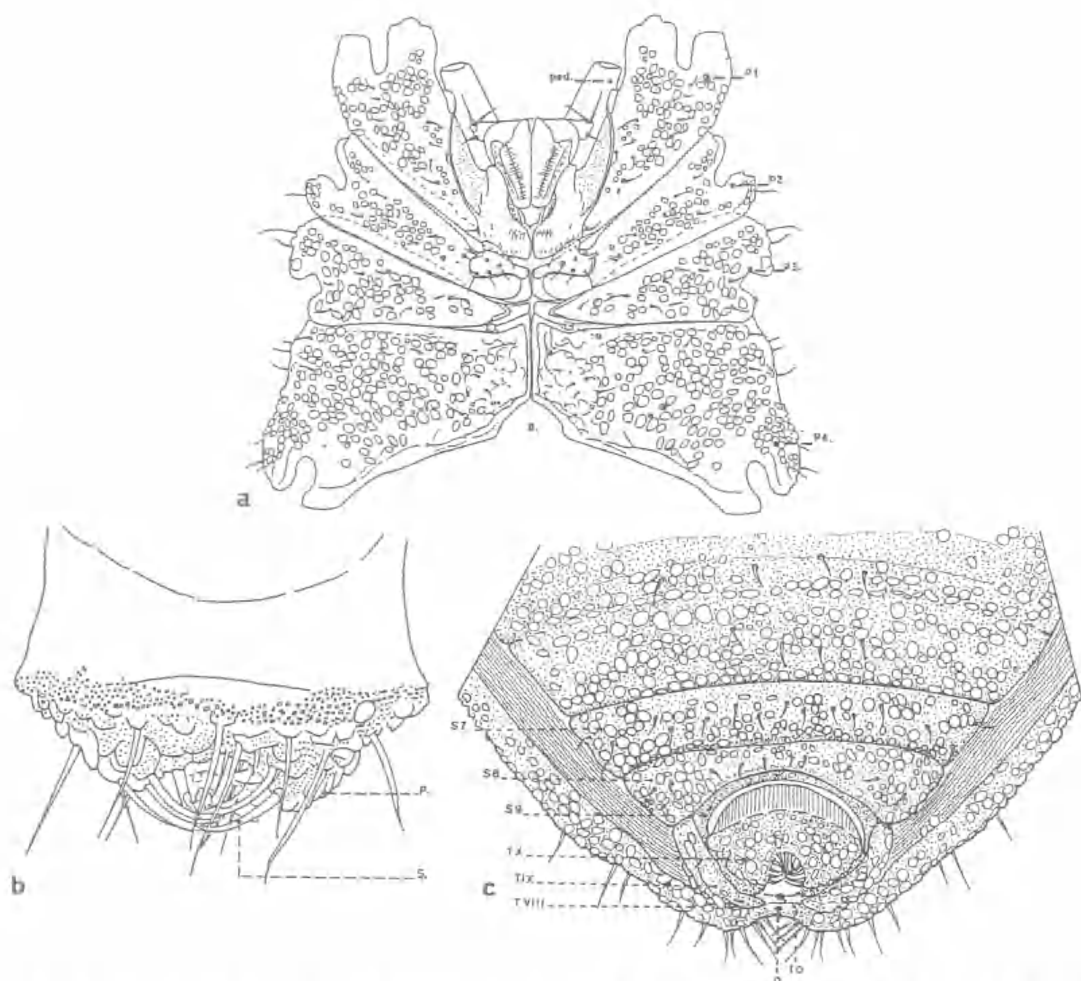


FIG. 3. ♂, ventral. a. p. 1-4, Coxae. b. Anal plate in anterior view. c. Posterior part of the body and corona analis. g = genital aperture; P = protuberance; S = sternite; T = tergite; o = opening of anal glands; to = twin openings.

legs I and II with numerous false-hairs, so-called chetoids. Tarsal claws smooth, asymmetrical in dorsal view, and with a low plate on the posterior side.

A puzzling feature which has not been investigated histologically is a narrow elongate area near the apex of the claw of leg II; it appears to join a canal running within the claw and/or to be connected to a gland in the apical part of the tarsus (Fig. 6a). However, no opening was seen with scanning electron microscope. A median groove on dorsal side of tarsi above claws may serve to receive claw. However, groove seems not so deep as in *Pettalus cimiformis*, *Ogovea grossa* and *Metagovea gabonica* where claws are surely retractile.

Tarsus IV and adenostyle (Figs 2, 5d, 6b). Tarsus IV is a single segment but semi-divided dorsally, seen clearly on scanning electron photograph (see arrow). Dorsal spur erected, subconical, with anterior margin much longer than posterior and provided with a translucent thorn inserted near apex on prolateral side. Opening of tarsal gland is near apex on posterior side. Adenostyle very similar to that of *Rakaia woodwardi* (see Forster, 1955, fig. 3) except that the long hair is inserted lower.

Penis (Fig. 7a, b): Very short with dorsal surface shorter than ventral. Apex of dorsal surface with a single, V-shaped series of long setae, 8 on the left and 9 on the right (a single penis examined); ventral surface with two long setae. From the

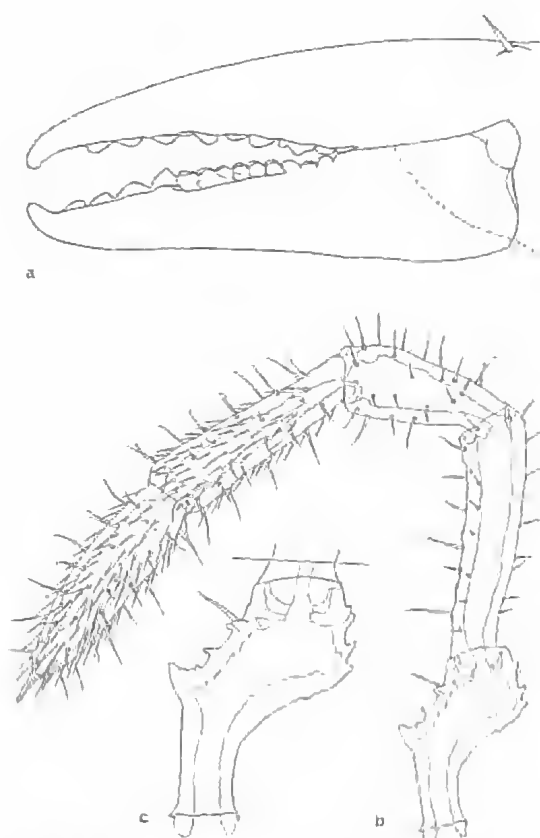


FIG. 4. *f.* a. Fingers of chelicerae. b. Pedipalp. c. Trochanter of pedipalp.

dorsal to the ventral side, the elements of the apical part of the penis are: 2 movable semicircular fingers with thin horns on these bases, inverted each side of gonopore; 1 short, trapezoidal, flat and smooth membranous lobe; 1 apical lobe, smooth, with 6 setae (3 on the left, 3 on the right) shorter than the dorsal setae.

DESCRIPTION OF FEMALE

It is like the male except that the posterior margin of abdomen is rounded; tergite IX entire and curved behind anal operculum which lacks scapula, granulate protuberances and median groove; tarsus IV without dorsal spur and not semi-divided.

Ovipositor (Fig. 7d): Long, with 26 joints and 2 terminal lobes. Each joint with 4 dorsal bristles and 4 ventral (sensilla chaetica); these bristles are short from joint 1 to 24, long on joints 25 and 26, 3 times as long as those on 24. Terminal lobes elongate, with normal bristles and 2 bristles as long as those of the last joint; each lobe with a subapical, lateral, 7-branched sensory process.

DISCUSSION

Forster (1955) distinguished *Neopurcellia* from *Rakaia* by a single character: tarsus IV of the male 2-segmented in former and 1-segmented in the latter. However, *R. daviesae* is intermediate and has the dorsal side of the single segment of tarsus IV of the male divided. The scanning electron photograph confirmed this feature which was not easy to interpret with the light microscope.

This suggests that perhaps *Neopurcellia* should be synonymized with *Rakaia* or a new genus described for *R. daviesae*. Since many characters of *R. daviesae* are similar to those of *R. woodwardi* (adenosytle, corona analis, leg I), I decided to include the new species in *Rakaia* and to retain *Rakaia* and *Neopurcellia* as valid genera.

In *R. woodwardi* and *R. daviesae*, the trochanter of pedipalp has a strong ventral process in common with many New Zealand species of *Rakaia* (*R. antipodiana*, *magna*, *dorothea*, *media*, *solitaria*, *pauli*, *sorenseni*, *isolata* and *uniloca*). The rest of the described species lack the trochanteral process on the ♂ palp. The significance of this feature in *Rakaia* is not clear; either it represents two phyletic series, or the trochanteral process is not a significant character.

PETALIDAE AND SIRONIDAE

Shear (1980) suggested a new and probably more accurate classification of the Cyphophthalmi, recognizing five families: Stylocellidae Hansen and Soerensen; Ogoveidae Shear; Neogoveidae Shear; Sironidae Simon; and Pettalidae Shear. He included all the austral Gondwana genera, except *Troglosiro*, in the new family Pettalidae. These were from Chile (*Chileogovea*, revised by Juberthie and Muñoz-Cuevas, 1970), South Africa (*Purcellia*, *Parapurcellia*), Sri Lanka (*Pettalus*), Australia and New Zealand (*Rakaia*, *Neopurcellia*). Pettalidae is closely related to Sironidae and the most significant morphological character distinguishing the two families is the number of kinds of cheliceral teeth: one in Sironidae and two in Pettalidae. Another character is less significant: the position of odoriferous gland tubercles (ozophores) which are types 1 and 2 in Sironidae, and type 2 or 3 in Pettalidae. Shear (1985) wrote of his new classification 'the diagnoses of these families were satisfying unequivocal . . . At that time, only a single cyphophthalmid species defied easy placement in my scheme: *Troglosiro* . . . Now a second species has come to light [*Marwe coarctia* Shear, 1985, from Kenya] so that its position is difficult to assess'.

The position of *Parapurcellia* is uncertain,

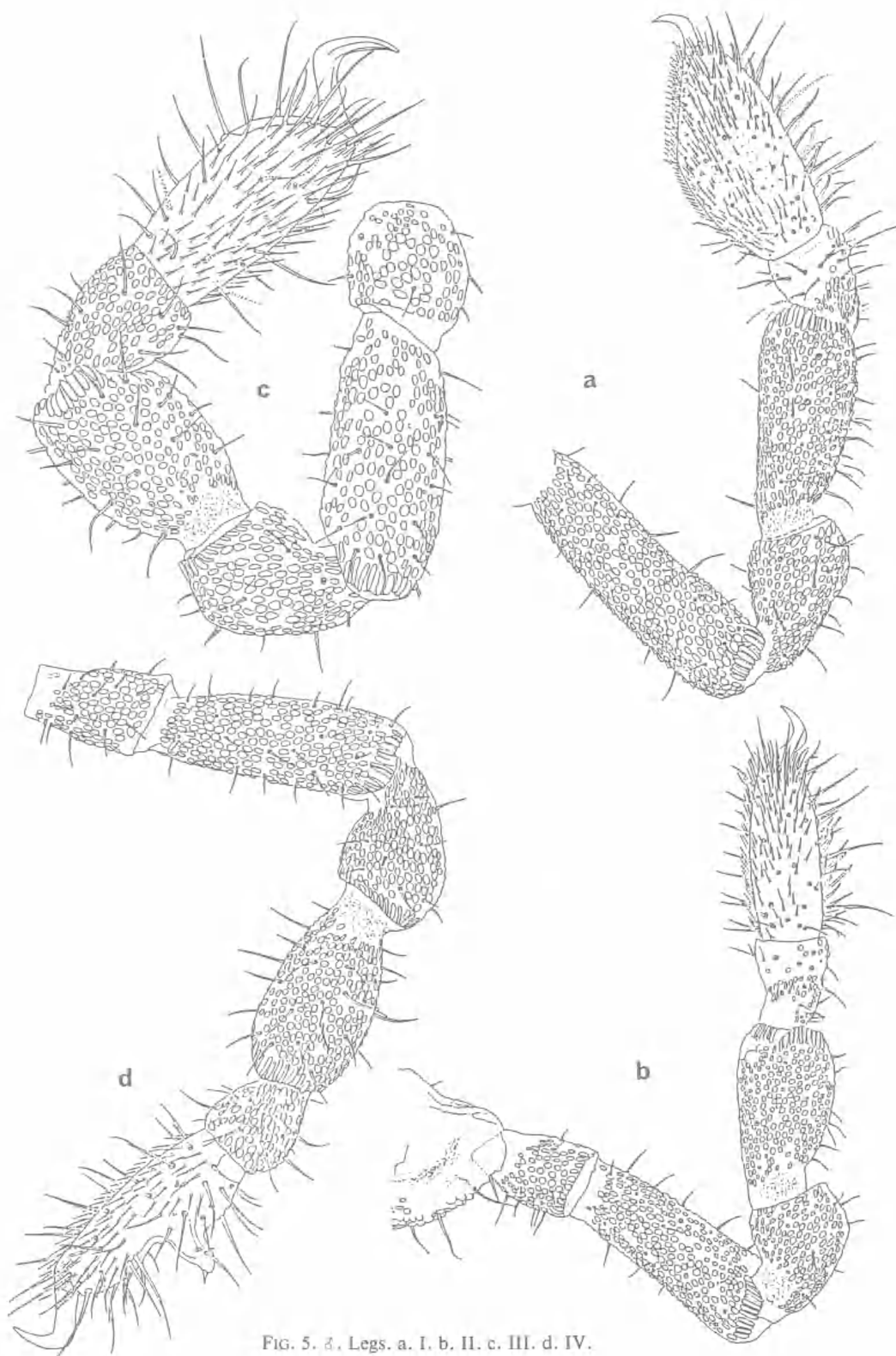


FIG. 5. *♂*, Legs. a. I. b. II. c. III. d. IV.

Adding to the brief description by Lawrence (1933, 1939), Juberthie (1970, figs 7a,b) found that δ *P. rumpiana* did not have the main characters of Pettalidae. As in Sironidae it has only one kind of cheliceral teeth and type 2 ozophores, that is, the ozophores (odoriferous tubercles) are set at a distance equal to their diameter from the lateral margin and 'project distinctly beyond the lateral margin of the carapace'. Further, according to Lawrence (1933) and Rosas Costa (1950), δ *P. rumpiana* differs from the δ in having type 3 ozophores as in Pettalidae. Lawrence (1963) agreed with Rosas-Costa in regarding the position of the odoriferous tubercles as of secondary importance, having no generic value. *Parapurcellia* is the only genus showing sexual dimorphism in the position of the odoriferous tubercles; in all other genera their position is a good character.

Two features of the anal region were also used by Shear (1980) to separate the two families. First, sternites and tergites of corona analis free (Pettalidae), partially or entirely fused (Sironidae). Secondly, anal region slightly modified, involving

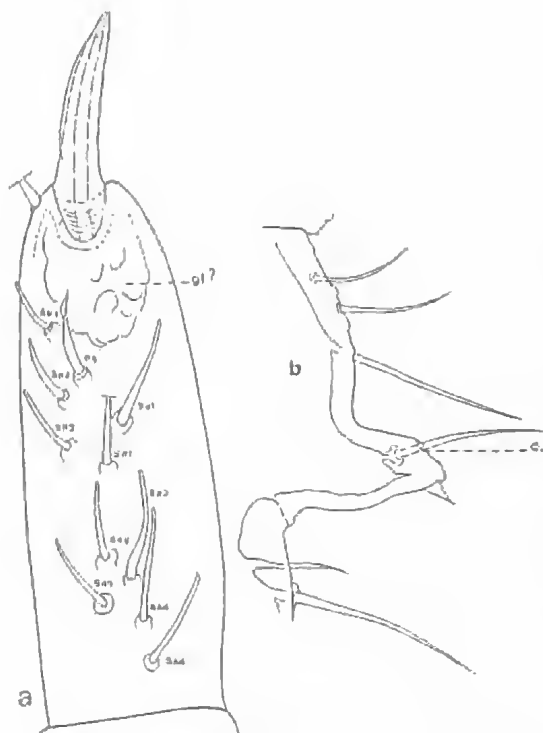
midline crest or groove in anal plate (Sironidae) and 'anal region strongly modified, modifications taking form of deep groove on anal plate, ninth tergite (which may be divided) and eighth tergite (which may be strongly bilobed), these grooves often with tufts of setae' (Pettalidae).

The first character is common to all species of Pettalidae except *Pettalus brevicauda* (in Juberthie, 1979) and *Pettalus cimiformis* (in Hansen and Soerensen 1904, plate III, fig. 2g), which have sternites 8 and 9 fused in the midline. For the second character, no Sironidae have a tuft of setae in anal region; in contrast numerous Pettalidae have setae within the groove of the anal operculum, and/or tergite VIII or on the internal side of the bilobate protuberances of tergite VIII; however a few species of *Rakaia* (*R. tumidata*, *calcarobtusa*, *granulosa*) and *Chileogovea oedipus* have a scopula in this region. The presence of tufts of setae in the groove of the anal operculum in *Parapurcellia rumpiana*, *P. silvicola* and *P. fissa*, and a scopula on the dorsal surface of anal plate in *Parapurcellia monticola*, similar to *Rakaia pauli*, *sorenseni*, *media*, *solitaria*, etc., is a feature which suggests the inclusion of *Parapurcellia* in Pettalidae.

Other characters are probably also important, but have not been described in all genera and species: (1) Tarsus I with a well developed ventral brush in the proximal half: *Pettalus cimiformis* and *brevicauda*, *Rakaia woodwardi*, *R. daviesae*, *Neopurcellia salmoni* and *Neopurcellia* n.sp. from Australia, *Chileogovea oedipus*, *Speleosiro argasiformis*, *Purcellia illustrans*. This brush seems more developed than in species of Sironidae from Europe and America for which descriptions are available; (2) Retractable claws. Authors have drawn little attention to this feature, which is not easy to observe. Several species and genera in Pettalidae have a deep dorso-apical and median groove to receive their claws: *Pettalus cimiformis* (Leg IV in Hansen and Soerensen, 1904), *Purcellia illustrans* (Legs III and IV examined by Juberthie, 1970), *Rakaia daviesae*, *Neopurcellia* n.sp. from Australia (Legs III, IV examined). It is premature to weight this character without examination of all genera of the Sironidae.

CONCLUSION

The Pettalidae, limited to *Chileogovea*, *Pettalus*, *Purcellia*, *Rakaia*, *Austropurcellia* and *Neopurcellia*, is a homogeneous family separated from Sironidae by the presence of two kinds of teeth on the movable finger of chelicerae.



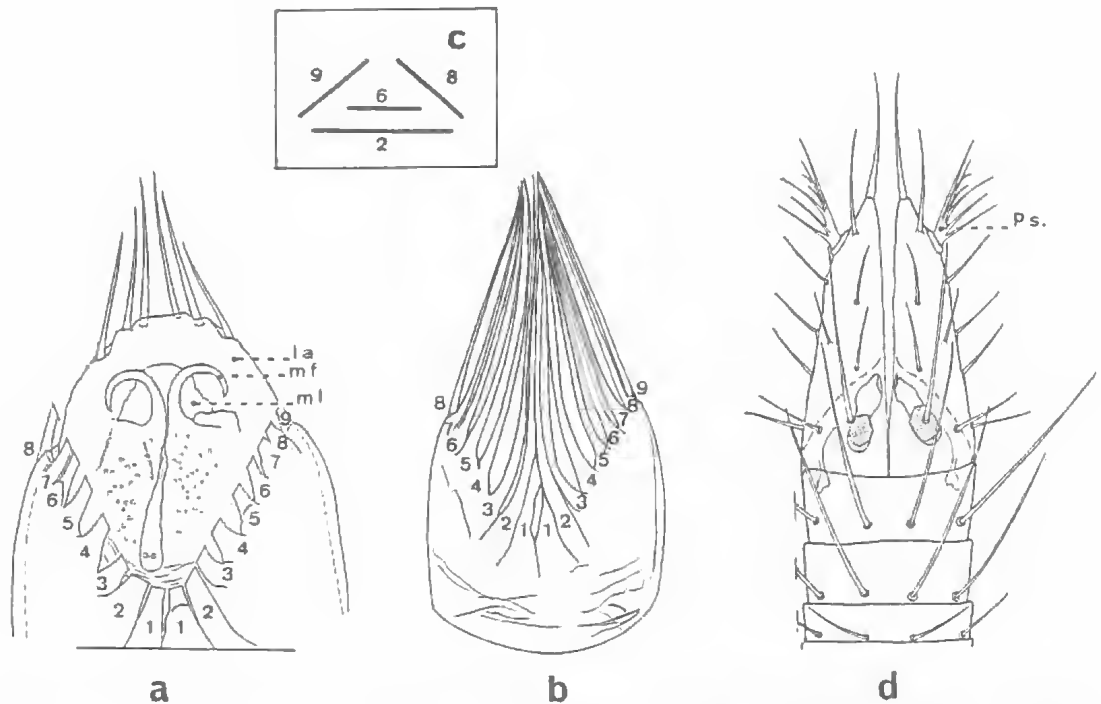


FIG. 7. a, b. Penis, ventral and dorsal view. c. Diagram of the setae of the penis. d. Ovipositor, apical part. Ps = sensory process; la. = apical lobe; mf = movable finger; ml = membranous lobe.

However, several other African and New Caledonian species (*Parapurcellia*, *Marwe*, *Troglosiro*) show not only the main character of Sironidae (one type of teeth), but also some characters of Pettalidae or peculiar features, so that the clade, Sironidae- Pettalidae, is probably a limited view of a more complex phylogeny.

All data suggest that the geographical distribution of cyphophthalmids (Juberthie and Massoud, 1976) is earlier than the breakup of Gondwanaland, 150 million years ago; these Opiliones were widespread before this event. At the present time, the majority of the cyphophthalmids probably represent relict species with a very low rate of evolution. For example, very small morphological differences have arisen between the populations of *Parasiro coiffaiti* in the French Pyrenees and *Parasiro minor* in Corsica, since the separation 20-25 million years ago of the European landmass and the Corsica-Sardinia crustal plate. The phylogeny is particularly difficult to determine as no fossils are known.

ACKNOWLEDGEMENTS

I am grateful to Valerie Davies, former Curator

of Arachnids, Queensland Museum who lent me specimens and to Gisele Ruffat for aid in the illustration of this paper.

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